

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION



TECHNICAL SERVICES DIVISION
RESEARCH & DEVELOPMENT SECTION

DATE MAY 1993

EXPERIMENTAL CONSTRUCTION 92-34

FIELD TRIAL OF GRAVEL STABILIZATION METHODS
ROUTE 1 CYR-VAN BUREN, ME

1ST INTERIM REPORT

INTRODUCTION

This experimental construction project was developed, designed, and inspected by personnel from the University of Maine, Civil Engineering Staff. The experimental project was constructed on and as a part of Project #2586.00. This was a complete reconstruction project 2.2 miles in length. The experimental section contains 6 experimental base types and is 1020 feet in length. The 1020 foot experimental section began at Station 1028+00 and ended at Station 1038+20. The test section consisted of 200 foot segments of soil-cement, asphalt-stabilized, and calcium chloride-stabilized materials, as well as two control sections and one 20 foot untreated section. The stabilized and control sections were located as follows:

Soil-Cement Stabilized	STA 1028+00 to 1030+00
Modified Subbase Control	STA 1030+00 to 1032+00
Asphalt Stabilized Section	STA 1032+00 to 1034+00
Untreated Section	STA 1034+00 to 1034+20
Calcium Chloride Stab. Section	STA 1034+20 to 1036+20
Standard Subbase Control	STA 1036+20 to 1038+20

Work on this project started in September 1990 and was completed in the summer of 1991. A construction report "Experimental Construction 92-34" was written in Dec. 1991 which provided a background of stabilization agents, their uses, advantages and disadvantages. This report also provided preliminary design results as well as test results obtained during the construction phases. In addition to the test results a plan for long term monitoring was also included in Appendix G. Some of the features to be monitored are rutting, and serviceability such as roughness and overall performance. Strength measurements using a Road Rater was also suggested. Most of the evaluations can be performed with the ARAN vehicle and the Road Rater. Long term monitoring of the calcium chloride is specifically mentioned. For this phase they recommend that test pits be dug every 5 years in order to monitor the possible leaching away of the calcium chloride. A revised project monitoring schedule is shown at the end of the report in Table I.

RESULTS

This first Interim report also included initial data and results that were computed after the project and the construction report was completed. The Road Rater deflection data were taken at various stages during the

construction period, but the results were not processed until the study was assigned to MDOT personnel for long term monitoring. As a result this report contains more information than an evaluation of the project after one years time.

Cross Section Study.

When the project was completed in the summer of 1992 cross section levels were taken by the UMO personnel to establish a standard reference. Within a very short period of time cross section levels were also taken by MDOT personnel for the purpose of obtaining final quantities for payment.

These two sets of data are within reasonable conformity with each other except for the first cross section at Station 1028+50. This particular cross section shows a difference in elevations of approximately 0.30 feet. As a part of the research study, cross section levels were taken again in the summer of 1992 after one year's elapsed time. The results of these three surveys are presented in Table II. Data pertaining to elevations and pavement settlements indicate that very little movement has occurred during the 1 year period. The greatest movement appeared to be at the edge of the paved shoulder or 22 feet left or right of centerline. However, even this movement or settlement is less than 1/2 inch. When settlement comparisons were made between original MDOT data and the data 1 year later even less movement was detected.

In order to avoid future confusion, two statements are necessary for clarity. (1) The cross sections shown in the Construction Report 92-34 should read that the elevations of the top layer represent the top of the wearing course and not top of the binder course as stated. (2) For reference work, the elevations of the cross section at Station 1028+50 should be based upon level readings determined by MDOT personnel. The level readings taken by MDOT agree with both sets of data while the UMO data does not agree with either set at this particular location.

Structural Evaluation Using Road-rater Deflections.

Deflection testing or strength measurements were obtained through the use of the road Rater at 4 different times. The first set of data were taken in Sept. 28, 1990 after the base course was completed. The second set of tests were conducted May 21, 1991 after the binder course was applied. The third set of data were taken in August 6, 1991 after the wearing course was applied. The fourth set was taken September 16, 1992 after the structure had been exposed to one year of traffic and environment. The criteria used in developing the structural parameters were as follows A 20 year design life, for a truck traffic rate of 110 18k loads per day, on a "till" type of soil subgrade. The pavement thicknesses in layers were as follows: 3 inches of asphalt concrete base grading B, followed by 1 3/4 inches of grading B binder, followed by 1 1/4 inches of grading C wearing course. The average of four deflection tests per subbase type are presented in Table III.

Examination of the structural information in Table III indicates that the "standard" subbase and the "modified" subbase are performing the same. This might be expected as the only difference is that oversize material in the standard base was scalped away in order to get a modified subbase. The calcium chloride section also appears to be acting similar to the standard and the modified sections. The asphalt stabilized section is slightly stronger

than the three granular subbase sections, but significantly weaker than the soil-cement section. The "soil-cement" subbase is performing in a distinctly different manner. The deflections are much smaller, it is providing better support, and the computations indicate it is the strongest section. These structural results indicate that in all 5 cases the road is adequately designed.

Visual Evaluation.

In the summer of 1992 the project was inspected and several photographs were taken. The photographs show that three transverse cracks have developed. One crack has developed in the soil-cement section near Station 1029+61, another crack has developed in the modified section near Station 1031+46, a third transverse crack was noted near Station 1034+42 in the calcium-chloride section. A fourth crack was noted near Station 1037+89 in the standard section. This fourth crack was detected on the ARAN video tape, it has not been confirmed in the field.

ARAN Results.

ARAN results from data taken August 17, 1992 are presented in Table IV. The format of this table is arranged in such a manner that the right side of the table refers to the northbound lane and the left side of the table refers to the southbound lane. The various sections are listed as they appear on the roadway. As future data are added this table will become wider. These results indicate that very little rutting has occurred. Although the rutting has doubled in the time span of one year it is still very small. The asphalt stabilized base section shows the greatest rutting in the first year, but it was surpassed by the untreated section the second year. The inside wheel path showed more rutting than the outer wheel path. This feature is not uncommon on roads with paved shoulders according to personnel in the office of pavement management.

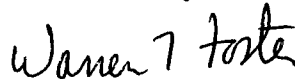
The lower portion of Table IV shows very limited roughness information. Additional information was taken but could not be processed because of the extremely short sections. The results presented indicate that all sections are "smooth". Smooth is considered as a value between 0 - 190, medium between 190 - 320, and rough as values in excess of 320 inches per mile.

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Distribution B

Other Available Documents

Construction Report Dec, 1991

TABLE 1

TESTING SCHEDULE FOR CYR - VAN BUREN
UMO PROJECT

Year	ARAN Roughness IRI	ARAN Rut	Road Rater	Elev λ-Sects	Elev Profile	Crack Survey	CaCl ₂ Leach
1991	*	*	*				
1992	*	*	*	*	*	*	
1993	*	*	*	*	*	*	
1994	*	*	*				
1995	*	*	*	*	*	*	1995
1996	*	*	*				
1997	*	*	*	*	*	*	
1998	*	*	*				
1999	*	*	*	*	*	*	
2000	*	*	*				2000
2001	*	*	*	*	*	*	
2002	*	*	*				
2003	*	*	*	*	*	*	
2004	*	*	*				
2005	*	*	*	*	*	*	2005
2006	*	*	*				

See Appendix G "Long Term Monitoring Program"

FIELD TRIAL OF
GRAVEL STABILIZATION METHODS

Route 1, Cyr Plantation - Van Buren
Construction Report
Technical Services Division
Experimental Construction Report 92-34
December 1991

THAT IS
ELEVATION CHANGE - IN ELEMENTS

POPS SECTION ELEVATIONS										DI-FIRE (CI FT M JMI)				DIFFERENCE FT M JMI					
										Lt 20	Lt 12	Lt 0	Rt 22	Rt 12	Rt 0	Lt 20	Lt 12	Lt 0	Rt 22
TOP		MM	42' 00	625 75	826 05	325 75	8 5 25												
Finals	3/ 91	1028+50	42' 01	825 45	825 75	325 51	8 5 05												
	6/30/92	10 Months	32' 01	825 43	825 74	325 47	8 5 03												
TOP		JMI	32' 81	825 20	825 50	25 25	824 75												
Finals	3/ 91	1028+50	32' 81	825 12	825 41	325 17	824 73												
	6/30/92	10 Months	32' 79	825 11	825 38	325 17	824 72												
TOP		JMI	32' 22	824 82	825 50	224 80	824 30												
Finals	3/ 91	1030+50	324 21	824 71	824 39	824 71	824 31												
	6/30/92		324 32	824 71	824 46	824 61	8 4 27												
TOP		JMI	32' 95	824 45	824 75	224 47	824 00												
Finals	3/ 91	1031+50	821 02	824 40	824 66	824 31	823 96												
	6/30/92		823 99	824 37	824 65	224 37	823 96												
TOP		JMI	823 55	824 00	824 28	824 00	823 55												
Finals	3/ 91	1032+50	32 53	824 04	824 28	824 04	823 62												
	6/30/92		822 54	824 01	824 28	824 01	823 60												
TOP		JMI	323 30	823 80	823 36	823 65	8 3 25												
Finals	3/ 91	1033+50	822 23	823 70	823 36	823 67	823 22												
	6/30/92		823 23	823 67	823 33	823 67	823 21												
TOP		JMI	322 95	823 35	823 60	823 28	822 30												
Finals	3/91	1034+50	822 90	823 34	823 62	823 34	822 86												
	6/30/92		822 87	823 31	823 59	823 24	822 82												
TOP		JMI	822 55	823 00	823 25	222 90	822 52												
Finals	3/ 91	1035+50	82 54	822 96	822 26	822 98	822 56												
	6/30/92		32 52	822 93	823 23	822 97	822 53												
TOP		JMI	822 25	822 70	822 35	822 60	822 15												
Finals	3/ 91	1036+50	822 22	822 66	822 96	822 86	822 20												
	6/30/92		322 17	822 65	822 92	822 82	822 19												
TOP		JMI	321 90	822 32	822 55	222 25	821 80												
Finals	3/ 91	1037+50	821 89	822 30	822 58	222 30	821 86												
	6/30/92		821 86	822 28	822 55	322 27	821 84												
TOP		JMI	*	*	*	*	*												
Finals	3/ 91	1038+50	821 52	821 92	822 20	821 92	821 48												
	6/30/92																		

TABLE III
CONSOLIDATED ROAD-RATER RESULTS
@ CYR PLANTATION / VAN BUREN
UMO EXPERIMENTAL BASE STUDY

Thickness	3"	4 3/4"	6"	6"	6"	6"
Date Measured	9/28/90	5/21/91	8/6/91	9/16/92	/	/

	DEFLECTION # 1 SENSOR (Mils) (Not temperature corrected)					
STANDARD B	4.49	3.55	2.04	1.47		
MOD SUBBASE	4.15	3.83	2.01	1.44		
ASPH STAB B	4.18	2.79	1.60	1.24		
CaCl ₂ STAB	4.21	3.20	2.05	1.54		
SOIL ² CEMENT	2.30	2.52	1.37	1.05		
	** COMPUTED SUBGRADE VALUE (ksi)					
STANDARD B	1.33	2.00	5.93	18.70		
MOD SUBBASE	1.77	1.46	5.20	16.88		
ASPH STAB B	1.69	3.37	9.43	20.10		
CaCl ₂ STAB	1.86	2.68	5.84	16.68		
SOIL ² CEMENT	8.70	4.27	15.92	20.83		
	** EFFECTIVE PAVEMENT THICKNESS (Inches)					
STANDARD B	0.00	2.14	5.41	4.00		
MOD SUBBASE	0.00	1.49	5.57	4.13		
ASPH STAB B	0.00	2.48	5.62	4.74		
CaCl ₂ STAB	0.03	2.77	5.71	4.14		
SOIL ² CEMENT	2.41	2.96	5.42	5.49		
	** PAVEMENT REQUIRED (Inches)					
STANDARD B	9.30	7.54	3.89	1.09		
MOD SUBBASE	8.39	8.33	4.07	1.09		
ASPH STAB B	8.47	5.45	2.43	0.85		
CaCl ₂ STAB	8.51	6.56	3.93	1.48		
SOIL ² CEMENT	2.98	4.65	1.31	0.58		
	** OVERLAY REQUIRED (Inches)					
STANDARD B	9.30	5.40	-1.52	-2.91		
MOD SUBBASE	8.39	6.84	-1.50	-3.03		
ASPH STAB B	8.47	2.97	-3.19	-3.90		
CaCl ₂ STAB	8.48	3.79	-1.78	-2.66		
SOIL ² CEMENT	0.57	1.69	-4.11	-4.90		

**

Temperature corrected deflections were used in Calculations

TABLE IV

PHYSICAL PROPERTIES

ARRN RUTS IN INCHES											
BASE TYPE	Southbound						Northbound				
	1993	1992	1991	1991	1991	1993	1992	1991	1991	1992	1993
Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner
Standard Base											
CaCl2	0.090	0.040	Missing	Missing			0.050	0.063	0.075	0.033	
Untreated B	0.033	0.010	"	"			0.050	0.088	0.115	0.054	
Asph Stab B	0.000	0.000	"	"			0.000	0.100	0.200	0.100	
Mod Subbase	0.067	0.025	"	"			0.088	0.038	0.175	0.075	
Soil Cement	0.092	0.025	"	"			0.050	0.038	0.108	0.003	
	0.083	0.033	"	"			0.088	0.038	0.145	0.091	

BASE TYPE	INTERNATIONAL ROUGHNESS INDEX							
	1993		1992		1991		1993	
	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner
Standard Base								
CaCl ₂			Missing	Missing		42.23	Missing	
Untreated B			"	"		47.09	"	
Asph Stab B			"	"	Missing		"	
Mod Subbase			"	"	70.97		"	
Soil Cement			"	"	58.09		"	
			"	"	55.67		"	